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XCII. *Extracts of Two Letters of the Abbé Nollet, F. R. S. to Mr. William Watson, F. R. S. relating to the extracting Electricity from the Clouds. Translated from the French.*

Paris, June 6. 1752. N. S.

Read June 11,
1752.

THE Abbé, after having taken notice of the discovery of M. Dalibard in France, in relation to the extracting the electricity from the clouds during a thunder-storm, in consequence of Mr. Franklin's hypothesis, acquaints Mr. Watson, that he is more interested than any body to come at the facts, which prove a true analogy between lightning and electricity; since these experiments establish incontestably a truth, which he had conceived, and which he ventured to lay before the public more than four years ago. Examine but the fourth volume of his *Leçons de Physique*, pag. 314, and you will find what follows: " If any one should
" take upon him to prove, from a well-connected
" comparison of phænomena, that thunder is in the
" hands of nature, what electricity is in ours; that
" the wonders, which we now exhibit at our pleasure, are little imitations of those great effects
" which frighten us; and that the whole depends
" upon the same mechanism; if it is to be demonstrated, that a cloud, prepared by the action of the
" winds, by heat, by a mixture of exhalations, &c.
" is opposite to a terrestrial object; that this is the
" electrified body, and at a certain proximity from
A a a a " that

" that which is not; I avow, that this idea, if it was
 " well supported, would give me a great deal of
 " pleasure; and, in support of it, how many spe-
 " cious reasons present themselves to a man, who
 " is well acquainted with electricity! The univer-
 " sality of the electric matter, the readiness of its
 " action, its inflammability, and its activity in giv-
 " ing fire to other bodies; its property in striking
 " bodies externally and internally, even to their
 " smallest parts; the remarkable example we have
 " of this effect in the experiment of Leyden; the
 " idea, which we might truly adopt in supposing a
 " greater degree of electric power, &c. all these
 " points of analogy, which I have been some time
 " meditating, begin to make me believe, that one
 " might, by taking electricity for the model, form
 " to one's self, in relation to thunder and lightning,
 " more perfect and more probable ideas, than what
 " have been offer'd hitherto, &c."

To demonstrate, that glass is not absolutely impermeable to the electric fluid, I offer the following experiment:

Let the neck of a small thin phial *A* (see the Fig.) be placed in that of the receiver *B*; and lute it in such a manner, as that the air cannot pass through their joining. Exhaust the receiver, and pour the little phial three parts full of water, and conduct the electricity therein, by means of an iron wire, suspended to the conductor. Make the experiment in a dark place, and, for the greater surety, fix the receiver to the plate of the air-pump, not with wet leathers, as usual, but with soft cement. You will see the electric matter pass, as through a sieve, through the small phial into the receiver, and

present

present itself in an infinite number of luminous streams, of extraordinary beauty ; and, if you do not take care, you will be smartly shocked, as in the experiment of Leyden, by laying one hand upon the receiver, and touching with the other the plate of the air-pump.

To prove, that, in the experiment of Leyden, the electrical virtue, or power of giving a shock, does not reside *only* in the glass, make the following experiment :

Electrify a phial two thirds full of water ; pour this water into another thin phial, placed upon a glass stand ; plunge therein an iron wire, and attempt, while the phial is in one hand, to draw a spark with the other ; it is certain, that, if this is done with a little readiness, you will make the experiment of Leyden with this water §. Possibly you may not always succeed with water ; but with mercury, under the same treatment, it never fails. Whence proceeds the power of giving the shock to the second glass, if it is not by means of the water, which it has received ?

Electrify a bolt-head of glass, void of air, and sealed hermetically ; you may make use of it for the experiment of Leyden, and you will succeed. Is

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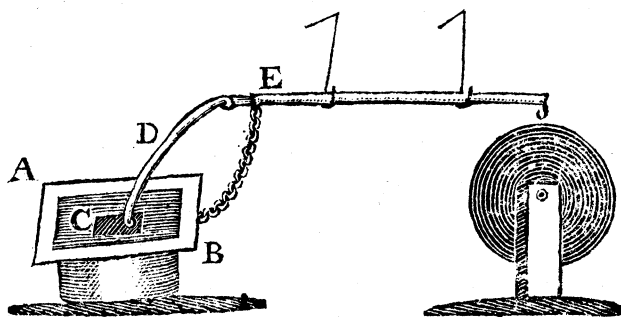
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§ Some years ago I shewed this experiment to several members of the Royal Society, and did not only therewith produce the experiment of Leyden, but by pouring the electrified water into a basin, held in one hand of an assistant standing upon cakes of wax, who, upon his presenting a finger of his other hand to some warm spirit of wine in a spoon, held in the hand of a person standing upon the floor, set it on fire. I then consider'd this experiment, as a proof of the electricity being accumulated in the water.

W. Watson.

there not then a communication between the exterior and interior surface of the glass? And is it not evident, further, that the electric matter, which is perceived running within like a torrent of fire, passes through the glass?

When you force a hole through a piece of paper or pasteboard, attend to one thing, which I constantly observe. If you electrify the plate of glass, *AB*, underneath, and that, by means of a thick iron wire somewhat bent, *D*, you draw the spark thro' a piece of pasteboard, *C*, placed upon the metal, with which the glass is coated, the hole will appear invariably larger underneath, than on the top of the pasteboard; and this hole will have an impression at the place, where the iron wire shall have been supported. These two effects leave no room to doubt, but that the stroke of fire was directed from the glass to the conductor, *E*, by the bent iron wire. Besides, if the electric fire proceeds from the upper surface of the glass, which receives the electricity from the under surface, it necessarily follows, that it must have passed through the whole thickness of the plate of glass; and, consequently, that the glass is not impermeable to the electric fluid.



Paris, July 22, 1752.

Read Dec. 14,
1752.

THE electrical experiments, which have been made here during the thunder, are now sufficiently verified. Dr. Le Monnier, assisted by his advantageous situation, has sufficiently experienced, first, that a bar of iron, pointed or not, is electrified during a storm: Secondly, that a vertical or horizontal situation is equally fitting for these experiments: Thirdly, that even wood is electrified: Fourthly, that, by these means a man may be sufficiently electrified to set fire to spirit of wine with his finger, and repeat almost all the usual experiments of artificial electricity; for thus I denominate that, which is excited by friction.

Seeing, therefore, that these experiments succeeded so well, I attempted them at Paris with a tube of tin, eighteen feet in length, and of an inch and half in diameter; half of which tube I put out of my window, while the other half was placed upon, and fastened to, silk lines: And though I live in the lowest part of Paris, and my apartment in the Louvre is cover'd with an immense building, both in height and extent, at any time when the thunder was but moderate, I perceived therefrom signs of electricity. The sparks were more frequent after the lightning than after the thunder; and it even seemed, that the clap of thunder put a stop, for a very short time, to the force of the electricity.

Monsr. Cassini de Thury, who was desirous of observing these effects with the apparatus, which we had erected upon the terrace of the observatory, made the same remarks; and he has had a greater opportunity

tunity of observing them, because the effects there were more considerable than at my apartment, on account of the situation. He even remarked to-day very evident signs of electricity, although there was neither lightning nor thunder, but only the sky cover'd with such thick clouds, as seem'd to forebode a storm.

Monf. Le Roy, a member of the Academy of Sciences, who lives near me, has repeated also a great number of these experiments and observations, by only making use of a pole of wood twenty-five feet long, about which he turned an iron wire in form of a screw.

This, Sir, is the state of these matters with us at present, which I am very far from thinking that we are arrived at the complete knowledge of. I have reasons for suspecting, that there frequently happens a natural electricity in the atmosphere. It may be, that thunder is only a circumstance, and not the efficient cause, of all these effects, which now present themselves to us; and it is not impossible, but that the great mystery of vegetation has great connection with this natural electricity. Time and observations may throw some light upon these important questions.